

The variable gain control of amplifier 7, FIG. 7(b) now acts to determine the working range of the system.

FIG. 4 is a schematic representation of the automatic pet door controlled by the transceiver of FIGS. 7(a) and (b) utilizing a transmitter arrangement identical to that of FIG. 2 wherein the transmitter of FIG. 7(a) is mounted within housing 72 and attached to a domestic animal by strap 76 with buckle 77 looping through the receiver casing and around the animal's neck. FIG. 16 shows the a typical working circuit of one embodiment of the automatic pet door. Here there is no need to use discrete transistors in the receiver to conserve power since the device is ultimately powered by household alternating current.

FIG. 5 shows that door casing 80 houses all of the elements of the receiver and door assembly. In this embodiment, an output device of FIG. 7(a) is a normally open relay 124, FIG. 16B, which routes power to motor 96, FIG. 5, when the transmitter signal is received by microphone 82. Movable panel 81, which is normally within opening 83 and completely obstructing it, is then guided upwards to allow the animal to pass through opening 83. FIG. 5 shows that door casing 80 of FIG. 4 is constructed by joining left frame member 90, right frame member 92, top frame member 91 and bottom frame member 93. Said frame members, in this embodiment, are custom wood mouldings but, could easily be made from extruded aluminium or plastic. Grooves 94 and 95 shown in FIG. 6, in left and right frame members 90 and 92 respectively, act to guide movable panel 81 along its path. Electric motor 96 is held in position by mounting bracket 97 and drives spool 98, which is rigidly fixed to motor shaft 99 with set screw 100. Cable 101 is thereby wound around spool 98 upon the counter-clockwise motion of electric motor 96. Cable 101 is looped around pulley 102 and prevented from slipping off pulley 102 by cable guide 103. Pulley 102 and cable guide 103 are rigidly attached to movable panel 81 with shoulder screw 104. Cable 101 is then fed to one end of locking pin 105, looped through a hole in that end and held in place by cable crimp 106. Locking pin 105 is held in place by bracket 108 and allowed to translate linearly in holes 106 and 107. Bracket 108 is rigidly fixed to movable panel 81 by screws 109 and 110. Compression spring 111 fitted around stepped shaft of locking pin 107 act to push locking pin 107 toward left frame member 90 and into hole 101 thus, preventing the movable panel from being moved out of opening 83 while there is slack in cable 101 as when motor 96 is idle. Thus, it is not possible for an intruder to manually lift movable panel 81. As cable 101 is wound around spool 98 when motor shaft 99 is rotated, the weight of movable panel 81 acts to create tension in cable 101. Said tension acts against compression spring 111 pulling locking pin 107 away from left frame member 90 and out of hole 101 freeing movable panel 81 and allowing it to move upward with cable 101. Front and rear plates 112 and 113, FIG. 6, respectively are locked into grooves 127 and 114 respectively and act to enclose the assembly. Holes 115, 116, 117, 118, 119 and 120, FIG. 5, are provided to mount the assembly to a household door or wall.

In this embodiment activation of electric motor 96 ultimately acts lift movable panel 81. When power is removed from electric motor 96, as in the absence of a signal sensed by the ultrasonic receiver of FIG. 7(b), movable panel 81 will return to its initial position under the force of gravity. As shown in FIG. 16B, the speed of return may be controlled by the addition of resistor 121 and diode 122 across the legs of electric motor 96 to create an electro magnetic field in the internal coil of electric motor 96 which is resistive to the

motion of motor shaft 99 in the direction of unwind thus, slowing the downward motion of the panel.

FIG. 16B further shows that the coil to relay 124 is energized upon sensing the ultrasonic signal. Timer 125 holds relay 124 on, providing power to motor 96, for a selected amount of time after the signal is lost. Electrical energy is stored in capacitor 123 on the counter-clockwise motion of motor 96 as movable panel 81 is hoisted upward. This same energy is released upon the deactivation of relay 124 providing a momentary surge of current to move motor 96 in the clockwise reverse direction in order to overcome any static friction in the system and start movable panel 81 on its downward path under the force of gravity.

What is claimed is:

1. A directional, ultrasonic transceiver for pets comprising:

an ultrasonic transmitter means for creating an ultrasonic signal within an elongated ultrasonic field envelope, said transmitter means possessing sound shaping means for further augmenting said ultrasonic field envelope to a more beam-like profile;

an ultrasonic receiver means for wearing by a pet for the detection of said ultrasonic signal within said elongated ultrasonic field envelope, said receiver means possessing means for delivering a sensory stimulus to said animal upon reception of said ultrasonic signal.

2. A directional ultrasonic pet detection system comprising:

a transmitter means for wearing by a pet, said transmitter means having a directional ultrasonic output, said ultrasonic output emitted in a direction downward toward the ground directly in front of said pet and bounced forwardly in the direction in which said pet is facing;

directional receiver means for detecting said forwardly bounced ultrasonic output, only when said pet is facing said receiver means;

means for converting said detected ultrasonic output to an electric voltage output for the activation of remote controlled apparatus for pets.

3. A directional, ultrasonic transceiver for pets comprising:

an ultrasonic transmitter means, for creating an ultrasonic signal within an ultrasonic field envelope, said ultrasonic transmitter means possessing modulation means for the creation of one or more modulation codes in said ultrasonic signal, said modulation codes being selectively transmitted;

an ultrasonic receiver means for detection of said ultrasonic signal within said ultrasonic field envelope, said ultrasonic receiver means possessing demodulation means to differentiate between said modulation codes and means for converting the said ultrasonic signal to one or more electric voltage outputs, the output selected depending upon the particular modulation code received, for the activation of various remote controlled apparatus for pets.

4. A directional, ultrasonic transceiver for pets comprising:

an ultrasonic transmitter means, for creating an ultrasonic signal within an ultrasonic field envelope, the output of said ultrasonic transmitter means comprising a series of ultrasound bursts having a predetermined pulse duration, said bursts being emitted at a predetermined rate of bursts per unit time,

an ultrasonic receiver means for detection of said ultrasonic signal within said ultrasonic field envelope; said

ultrasonic receiver means employing a method of rejecting environmental noise and surface reflections of the bursts by sensing the low to high transition of a first received burst then rejecting any low to high transition of a next received burst which does not occur within a predetermined, narrow window of time and further rejecting said low to high transition of said next received burst if it is not approximately equal in peak amplitude to said low to high transition of said first received burst, said receiver means further measuring the time duration between said first and next received bursts and activating an electric voltage output means, for the operation of remote controlled apparatus for pets, only when a predetermined number of bursts have been received and accepted at said predetermined rate of bursts per unit time.

5. A directional ultrasonic detection system to chase pets out of restricted areas comprising:

transmitter means for wearing around the neck of a domestic animal, said transmitter means having a directional ultrasonic output, said output downwardly pointed toward the ground directly in front of said domestic animal and bounced forwardly in the direction in which said animal is facing;

directional receiver means for detecting said ultrasonic output only when said animal forwardly approaches said receiver means on a proximate line of sight path;

means for creating a sensory stimulus at said receiver means for training said domestic animal to retreat from said receiver means upon said detection.

6. The invention of claim 5 wherein said sensory stimulus is a visible light ray.

7. The invention of claim 5 wherein said sensory stimulus is a sonic alarm.

8. A self opening and closing pet door to automatically open in the presence of an ultrasonic signal and automatically close in the absence of said signal comprising:

a transmitter means for wearing by a pet, said transmitter means having a directional ultrasonic output, said ultrasonic output emitted in a direction downward toward the ground directly in front of said pet and bounced forwardly in the direction in which said pet is facing

directional receiver means for detecting said forwardly bounced ultrasonic output, only when said pet is facing said receiver means;

means for converting said detected ultrasonic output to an electric voltage output;

a casing with opening to allow a domestic animal to pass from one side of said casing to another,

a movable panel normally placed within said opening to obstruct the path of the animal through said casing,

means for moving said movable panel out of said opening in said door casing upon reception of the transmitted ultrasonic signal by said ultrasonic receiver means,

means for guiding said movable panel along its path,

means for attaching said casing to a wall or door of a building structure.

9. The invention of claim 8 wherein, said receiver means possesses means to effectively control the distance from the domestic animal at which said receiver means detects said ultrasonic output.

10. The invention of claim 8 wherein the means to move said movable panel comprises an electric motor, a spool attached to the shaft of said electric motor, a cable, one end of which is attached to said spool, the other of which is attached to said movable panel for the purpose of raising said movable panel as said cable winds around said spool as said spool rotates with the shaft of said electric motor.

11. The invention of claim 10 wherein, return of said movable panel to its normal position within the opening of said casing is automatically accomplished by the force of gravity once said electric motor is deactivated in the absence of reception of said ultrasonic output by said receiver means.

12. A directional, ultrasonic area restriction system for animals comprising:

an ultrasonic transmitter means and sound shaping means, for creating an ultrasonic signal within an elongated ultrasonic field envelope, said ultrasonic field envelope having an outermost boundary, said outermost boundary having its length several times greater than its width;

ultrasonic receiver means for wearing by an animal, said receiver means for detection of said ultrasonic signal when said animal, approaching from outside of said ultrasonic field envelope, crosses said outermost boundary;

means for creating a sensory stimulus to said animal upon reception of said ultrasonic signal by said receiver means, said sensory stimulus being for the purpose of training the animal to avoid crossing said outermost boundary of said ultrasonic field envelope.

13. The invention of claim 12 further comprising, means for attaching said ultrasonic transmitter means to a positioning post to be placed in the ground.

14. The invention of claim 12 wherein, the transmitter means alternately generates two separate modulated signals to define two independent boundaries, the receiver means thereby independently activating a warning tone output and a shock output depending upon which modulated signal is received.

15. The invention of claim 12 further comprising a variable gain control at said transmitter means to effectively control the size of said ultrasonic field envelope.

16. The invention of claim 12 wherein, said sensory stimulus comprises a sonic alarm.

17. The invention of claim 12 wherein said sensory stimulus comprises an electric shock.

18. The invention of claim 12 wherein said sensory stimulus comprises a warning tone followed by an electric shock.

19. The invention of claim 12 wherein, said ultrasonic field envelope approximates a beam transmitted along the perimeter of an area to restrict animals to roaming within said perimeter and further comprising a pair of said transmitter means attached to a positioning post to be placed in the ground to establish one corner of the restrictive perimeter.

20. The invention of claim 19 wherein, said pair of transmitter means are mounted within casings and allowed to rotate relative to one another to adjust the angle of said corner.

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21. An automatic pet door comprising:

a casing defining a door opening;

a panel movably connected to said casing within said door opening;

a motor attached to said casing;

a cable having a first cable end attached to said motor and having a second cable end attached to said panel; and

an signaling means worn by a pet, said motor selectively moving said panel to open said door in response to said signaling means.

22. The door of claim 21 wherein said motor has a rotatable drive shaft to which a spool is attached wherein said first cable end is attached to said spool so that said cable is wound around said spool during operation of said motor.

23. The door of claim 22 further comprising a locking pin releasably connected to said panel and having an attachment end and a free end, said second cable end being attached to said attachment end of said locking pin.

24. The door of claim 23 wherein said casing includes a locking pin hole and further comprising a means for biasing said free end into said locking pin hole, said biasing means being attached to said panel.

25. The door of claim 22 further comprising an pulley attached to said panel, said second

cable end being threaded through said pulley and being attached to said attachment end of said locking pin.

26. The door of claim 24 wherein said door is in an open position when a predetermined length of said cable is wound around said spool, and said locking pin is disengaged from said locking pin hole.

27. The door of claim 26 wherein said door has a closed position when said predetermined length of said cable is unwound from said spool and said locking pin is in said locking pin hole.

28. The door of claim 27 wherein said panel moves from said open position to said closed position within said door opening by the force of gravity when said motor is deactivated.

29. A pet door comprising:

a panel;

a casing defining a door opening, said panel being slidably mounted to said casing for movement within said door opening;

an drive means for selectively moving said panel; and

a transmitter means attached to a pet, which activates said drive means only when said pet is facing said door.

30. The door of claim 29 wherein said drive means further comprises:

a motor attached to said casing;

a cable having a first cable end attached to said motor and having a second cable end attached to said panel.

31. The door of claim 30 further comprising a locking pin movably connected to said panel and having an attachment end and a free end, said second cable end being attached to said attachment end.

32. The door of claim 31 wherein said casing includes a locking pin hole and further comprising a means for biasing said free end in said locking pin hole, said biasing means being attached to said panel.

33. The door of claim 32 wherein said motor has a drive shaft to which a spool is attached wherein said door is in an open position when a predetermined length of said cable is substantially wound around said spool and said locking pin is disengaged from said locking pin hole.

34. The door of claim 32 wherein said door has a closed position when said predetermined length of said cable is unwound from said spool and said locking pin extends into said locking pin hole.

35. The door of claim 29 wherein said transmitter means emits a directional ultrasonic output in a forward direction and a downward direction from said pet and further comprising a receiving means electrically connected to said motor for receiving said directional ultrasonic output.

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